

Vapor Compression Refrigeration Loop with Spray Cooling for High Heat Flux Thermal Control, Phase I

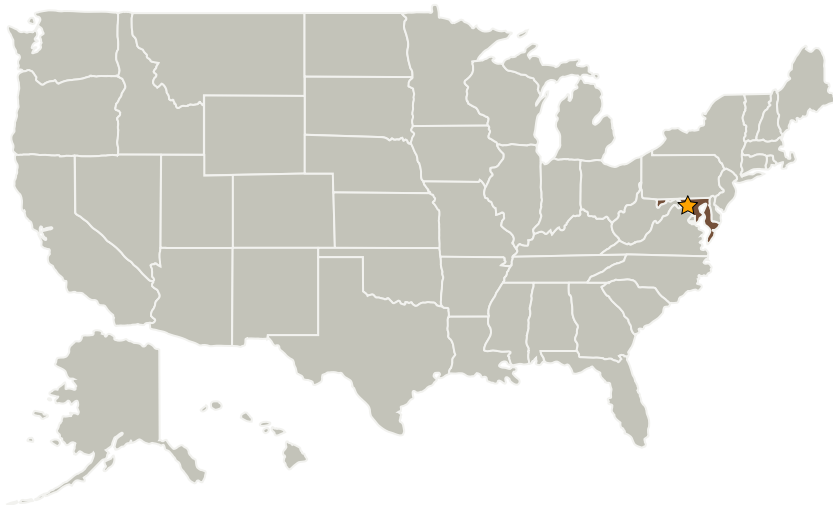
Completed Technology Project (2004 - 2004)



Project Introduction

Laser diodes are the key component in many space-based applications ranging from communication systems to optical sensors/detectors. Laser diode emitters however dissipate large amounts of waste heat of their own from the small footprint of the device. As a result, the dissipating heat flux from the laser diodes can reach a level as high as $1\text{kW}/\text{cm}^2$. The performance and reliability of laser diode arrays can degrade severely if the waste heat is not properly managed. Indeed temperature control is critical when the laser diode arrays are used for pumping a solid-state laser such as Nd:YAG. The solid-state laser has a narrow absorption bandwidth and requires a narrow pump source. Any variation in temperature throughout the array will cause the emitters to emit different wavelengths, thus increasing the bandwidth of the array. Spray cooling is probably the only available thermal control technology capable of dispersing heat fluxes of this extreme level ($>200\text{W}/\text{cm}^2$). Spray cooling is a heat removal method by an evaporative heat transfer process. In this research project, a novel concept that combines a conventional refrigeration cycle and spray cooling technique into one system is proposed as the solution to extremely high heat flux problems.

Primary U.S. Work Locations and Key Partners



Vapor Compression
Refrigeration Loop with Spray
Cooling for High Heat Flux
Thermal Control, Phase I

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Organizational Responsibility	1
Project Management	2
Technology Areas	2

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission
Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center
(GSFC)

Responsible Program:

Small Business Innovation
Research/Small Business Tech
Transfer

Vapor Compression Refrigeration Loop with Spray Cooling for High Heat Flux Thermal Control, Phase I

Completed Technology Project (2004 - 2004)



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
TTH Research, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Laurel, Maryland

Primary U.S. Work Locations

Maryland

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Triem Hoang

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.2 Thermal Control Components and Systems
 - └ TX14.2.2 Heat Transport